Unit 1

Pipes – Cutting, Threading, Joining and Testing of Pipelines

INTRODUCTION

In Class IX, you have studied important tools used for plumbing, plumbing materials, plumbing pipes, measurement and symbols used in plumbing as well as pipe fittings, joints and valves. In this textbook, we will be discussing related features of plumbing.

For successful installation, fixing and testing, various types of operations are carried out. These are cutting, threading, joining and testing.

CUTTING

Pipe is one of the important materials in plumbing work. As per requirement, a pipe is cut into different sizes. A pipe is cut manually or with a machine**.** The length of a pipe to be cut should be marked on the pipe with a pencil.

Common tools used for pipe cutting are as given below.

(a) Plastic tubing cutters

(b) Wheel cutters

(c) Hacksaws

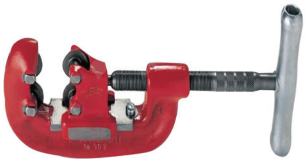


Fig. 1.1: Plastic cutter

- **Plastic tubing cutters** are used for thinner pipes and tubes, such as a sprinkler pipe.
- **Wheel cutters**, with a sharp wheel are used for thicker pipes. It has an adjustable jaw grip. It is used in areas where a complete turn is not possible. A wheel cutter is used by rotating it around the pipe and repeatedly tightening it until it cuts all the way through. During the cutting process, a small burr is left in the pipe, which creates hurdles. The burr should be cleaned or reamed.

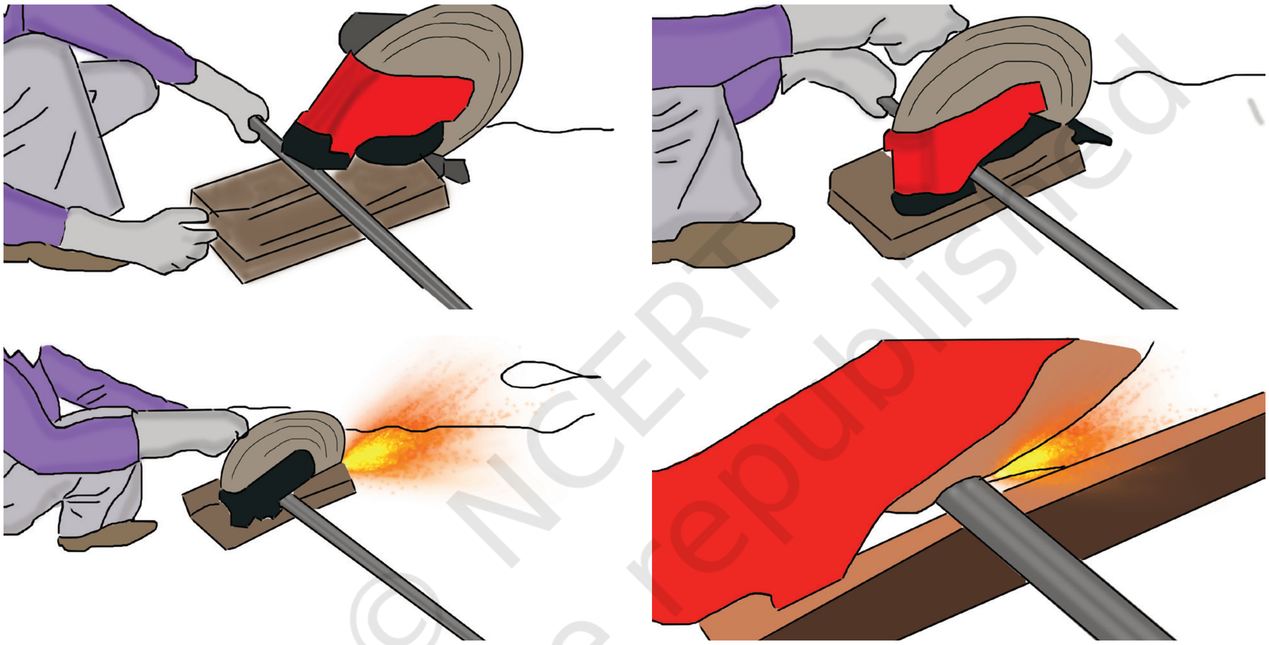


Fig.1.2: Wheel cutter

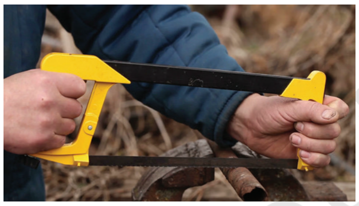


Fig.1.3: Cutting with a hacksaw

- **Hacksaws** are used for cutting metal and plastic pipes. A hacksaw should be held properly when cutting a pipe. The blade of the hacksaw should be changed when it becomes blunt.

THREADING

You already know that during installation of plumbing pipes and fixtures, joining is done with the help of screws and threads. The purpose of threading is to create a screw thread. Threading is done with a tap or faucet and dies. Tap or faucet and dies are cutting tools used to create screw threads.

(a) A tap or faucet is used to cut the internal portion of the bolt (for example, a nut).

(b) A die is used to cut the external portion of the bolt (for example, a screw).

(c) The process of cutting threads using a tap or faucet is called tapping/fauceting, whereas the process of using a die is called threading.

(d) Both the tools can be used to clean up a thread, which is called chasing.

(e) A tap or faucet cuts a thread on the inside surface of a hole, creating a surface, which functions like a nut.

(f) The die cuts a thread on a preformed cylindrical rod, which creates a threaded piece that functions like a bolt.

(g) Unlike drill bits, hand tap or faucets do not automatically remove the chips they create.

Thread Cutting

Thread cutting is used when a full thread depth is required, the quantity is small and the blank is not accurate. A common method of threading is cutting with taps and dies. A hand tap cannot cut its threads in a single rotation because it creates long chips, which quickly jam the tap.

In manual thread cutting, normal wrench usage is to cut the threads ½ to ⅔ of a turn (180 to 240 degree rotation), then reverse the tap for about ⅙ of a turn (60 degrees) until the chips are broken by the back edges of the cutter. A threaded pipe is a pipe with screw-threaded ends for assembly. Threaded pipes used in some plumbing installations for the delivery of gases or liquids under pressure, have a tapered thread that is slightly conical.

Determine the Threads per Inch

Tapping is done when the threads are cut into a hole. A die set is used to cut threads onto a cylinder (bolt). To use a tap or a die, first determine the number of threads per inch (TPI) of the part to be fixed. A gauge system that has a number of different pins can be used

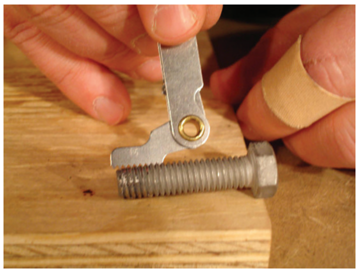


Fig. 1.4: Measuring the thread per inch

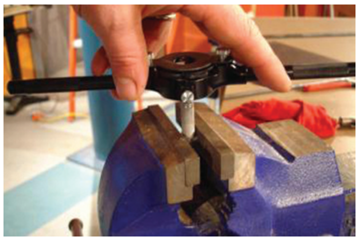


Fig.1.5: Creating a thread

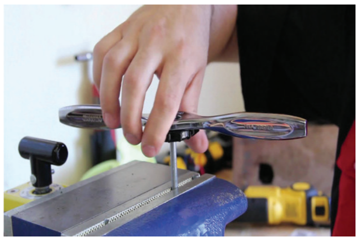


Fig. 1.6. Turning steel rod into a bolt

to calculate the TPI of a bolt or nut. After determining the TPI of a bolt, choose the die that corresponds to it. A tapered die will tell which side to begin using. The die fits into a special wrench that holds and guides it.

Create New Threads

To use the die to create new threads on a worn out bolt, first place the bolt into a vise to hold it as the wrench is turned over it. Cutting metal with metal can create heat, so some cutting oil is used to lubricate the bolt. Place the die over the bolt and hold it horizontally. Turn the wrench. The die will catch the threads already cut into the bolt. Every couple of turns, reverse the wrench about half a turn to clear the threads so that the die cuts better. Also, re-apply cutting oil throughout the process. Turn the wrench until the bolt comes past the top of the die.

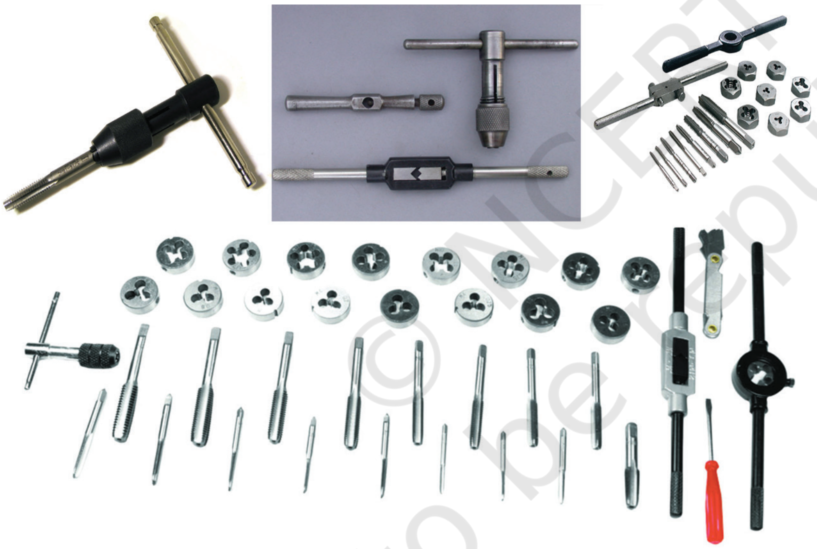


Fig.1.7: Tap and Die

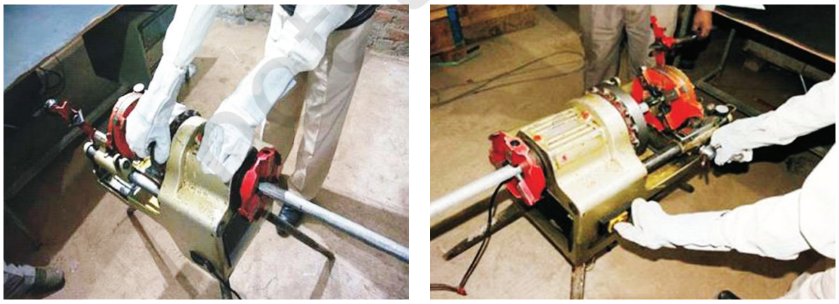


Fig.1.8: Pipe threading using pipe threading machine

Turn a Steel Rod into a Bolt

A die set can also be used to turn an ordinary steel rod into a bolt. To do this, the rod must have a beveled end. If necessary, chamfer the end of a rod on a grinder to get a bevel. The die will not work well with a flat-ended rod. Lubricate the rod often, as when cutting into a worn bolt. Make turns slowly.

To use a tap, choose a size that is appropriate for the size of the bolt or the hole you want to thread. Place the tap into the special wrench and tighten it. Then, place the cutting end of the tap over the hole and turn. Use cutting oil to lubricate the tap. As with the die, once the tap starts, make a slight reverse turn every now and then.

Pipe Threading Machine

This machine is used for making thread in a pipe. The pipe is fixed in the jaws of the machine. As per the pitch of the thread, the setting is made in the die. It is rotated slowly and the thread is created.

A pipe threader is used to cut grooves or threads in to the end of a metal pipe. These grooves are similar to those found on a conventional screw. The threads on the pipe fit into a pattern of threads in the connector, allowing users to screw the two components together by hand. Before threading the pipe, plumbers use a pipe-cutting tool to cut the pipe to the desired length. The end of the pipe is then inserted into the pipe threader. Special cutting tools or dies, within the threader can be used to create the proper thread profile and depth.

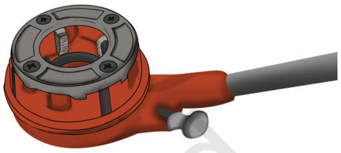
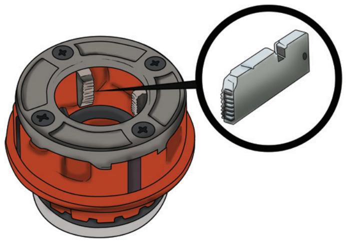
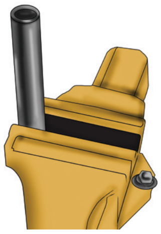


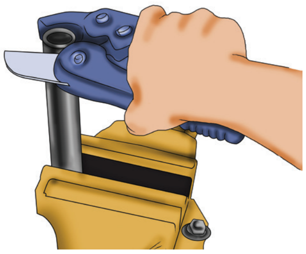
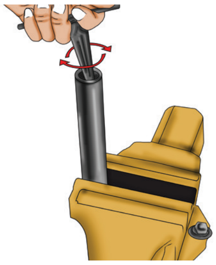
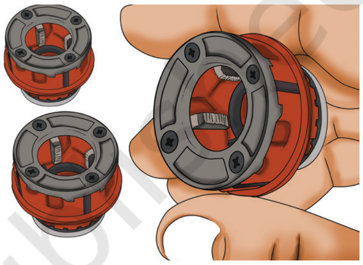
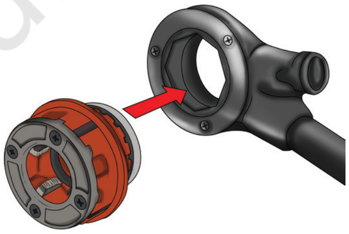
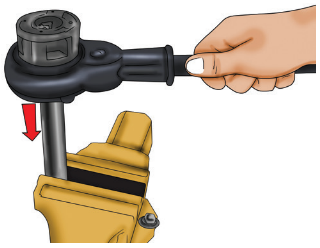
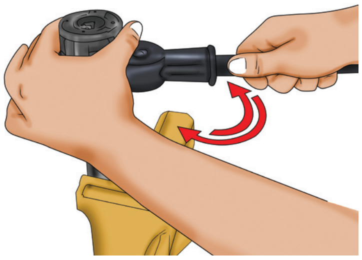
Fig.1. 9: Pipe Threader

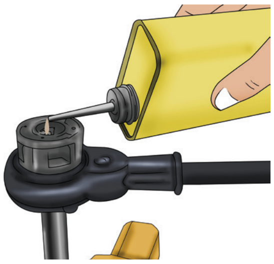
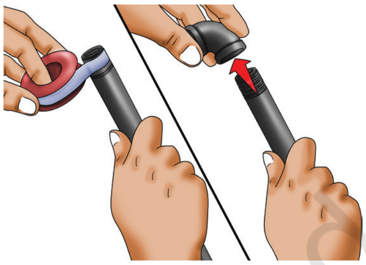
Process of Threading a Pipe

Before starting the threading process, all the tools to be used should be stored properly. Proper care should be taken during the process. The steps of threading are explained in Table 1.1.

Table 1.1: Steps of Threading a Pipe

Check and inspect the pipe threader before beginning. Worn out or damaged dies can result in poor thread quality.	
Mount your pipe firmly in the pipe vice tightly.	

Cut the end of the pipe smoothly and squarely by using a pipe cutter.	
Ream the cut end of the pipe to remove any burrs from the cut using a reamer. It is a cylindrical rotary cutting tool that you run smoothly across the freshly cut edges of the pipe to remove rough edges.	
Select your die head according to the size and type of pipe you are threading and the thread form you require. Die heads come in different shapes and sizes that include different threads for pipes that have different diameters.	
Place the die head over the pipe on the threader.	
Press steadily on the front of the die head, while simultaneously pushing the handle down to start the threader. Before putting too much pressure on the handle, check to be sure the ratchet pawl is engaged.	
Use your weight as leverage to apply pressure on the handle, while holding it firmly. Be sure to maintain a proper footing and balance for maximum control. Otherwise, this can be dangerous and could result in an injury.	

Reverse the ratchet mechanism and turn the die head in the opposite direction. Be careful to maintain control of the threader and move the piece smoothly as the dies are removed and the threads can get damaged.	
Clean the pipe with a cloth, removing oil if any. Be careful as the threads are sharp. Seal the threading with Teflon tape or faucet or a pipe thread compound when attaching the pipe to the connector.	

JOINING OF PVC PIPES

Joining is the method of joining non-metallic, plastic pipes. It does not require threading of ends. Chlorinated Polyvinyle Chloride (CPVC) pipes are joined using a solvent cementing technique.

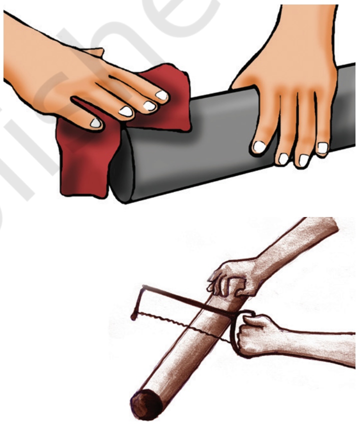


Fig.1.10: Cut and clean the edges of the pipe

CPVC Solvent Cementing

1. The following points should be clearly understood.
2. The joining surfaces must be softened and made semi fluid.
3. Sufficient cement must be applied to fill the gap between the pipe and the fitting.
4. The assembly of the pipe and fittings must be made while the surfaces are still wet and the cement is still fluid.

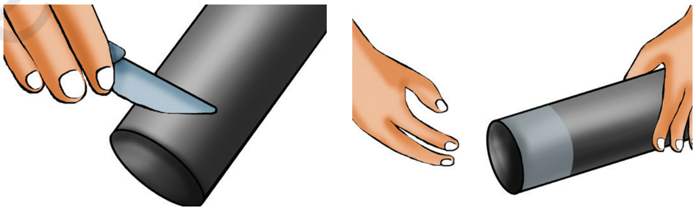


Fig.1.11: Apply the solvent on both the edges

5. Joint strength develops as the cement dries. In the tight part of the joint the surfaces tend to fuse together. In the loose part, the cement will bond with both the surfaces. These areas must be softened and penetrated.

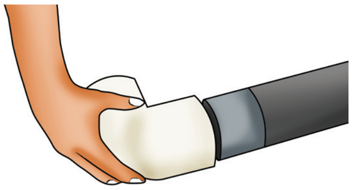
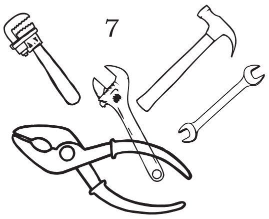


Fig.1.12: Assemble the edges when the cement solvent is wet



METHODS OF TESTING PIPELINES

Testing the pipeline is necessary after installation. There are four different testing methods of the pipeline, which are as follows.

Smoke Test

This test is done in the case of leakage in CI pipe.

1. Smoke is released from the bottom of the pipe.
2. Smoke can be detected from the leaked portion, if any.
3. Smoke testing refers to physical tests on closed systems of pipes to detect cracks or breaks.
4. In plumbing, a smoke test forces non-toxic, artificially created smoke through waste and drain pipes under a slight pressure to find leaks.
5. Plumes of smoke form where there are defects.
6. This test can be performed when the plumbing is brand new. More often it is used to find sewer gas leaks that may plague a building or an area.
7. Any sign of smoke escaping can be considered a possible site for sewer gas to escape. Plumbing

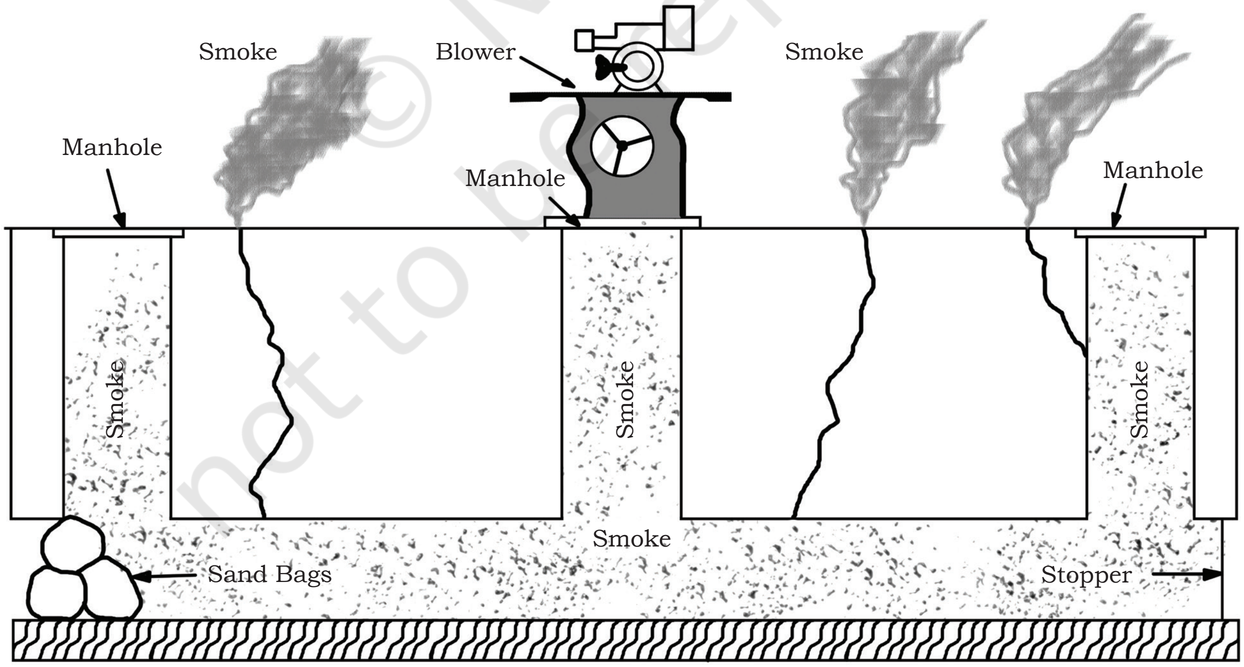
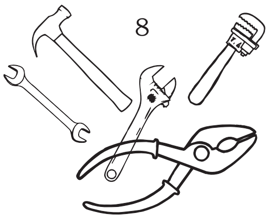


Fig.1.13: Smoke Test



smoke tests are also used to find places where pipes will spill fluid, and to check sanitary sewer systems for places where groundwater and storm runoff can enter.

Pressure Hydraulic Test

This test is also done to detect leakage in the pipes.

1. For pressure test, open the ball valve on the pressure tester and then connect a garden hose to the tester.
2. Turn the hose on and allow the pressure in the pipes to reach 30 pounds per square inch (psi). This usually takes several minutes.
3. When it reaches 30 psi on the gauge, close the ball valve on the pressure tester assembly and then turn off the hose. You can now disconnect the hose from the pressure tester assembly.
4. The pressure should stay at 30 psi.
5. Leave the hose on at this pressure for several hours to make sure you do not have a small leak.
6. If the gauge does begin to drop slowly, check the plumbing for leaking water.

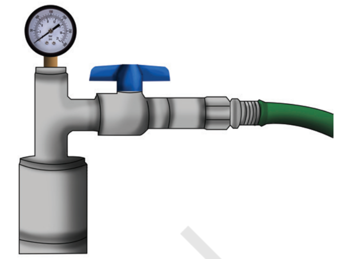


Fig.1.14: Pressure Hydraulic Test

Practical Exercises

Activity 1

Cutting of the PVC Pipe

Material required

1. Cutting tool
2. PVC pipe
3. Hacksaw
4. Wheel cutter

Procedure

1. Select a PVC Pipe.
2. Mark with a pencil on the PVC pipe, where cutting is to be done.
3. Take a hacksaw and check whether the blade is fitted properly or not.
4. Keep the pipe on a table hold the pipe.
5. Cut the pipe with the help of hacksaw.

6. Fix the pipe in the wheel cutter and slowly cut the pipe.
7. Remove the burr around and inside the PVC pipe.

Activity 2

Threading in PVC pipe

Material required

1. PVC or metal pipe
2. Taper die
3. Bench vice
4. Pencil
5. Pipe threading machine
6. Tap
7. Teflon Tape

Procedure

1. Take a pipe.
2. Fix in a bench vice.
3. Identify and collect the die.
4. Fix the die in the tap.
5. Rotate the tap and die slowly.
6. Thread will be created on the pipe.
7. Pipe threader may be used for making grooves in the metal pipe.

Instructions

1. Clean the pipe with the help of a cloth and remove any oil.
2. Seal the thread with a Teflon tape.

Activity 3

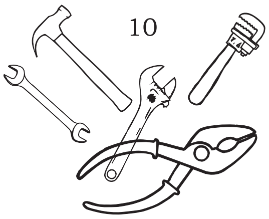
Joining of PVC pipe using adhesive

Material required

1. PVC pipe
2. Brush
3. Adhesive

Procedure

1. Clean the end of the pipes with a cloth.
2. Fit one pipe into the other without adhesive.
3. Check that both the components are matching.
4. With the help of a brush apply the adhesive solution to the end of the pipe.
5. Hold the pipe material for a few minutes.
6. The pipes will join.



Check Your Progress

Notes

A. Short answer questions

1. List the three cutting tools used for cutting pipes.
2. Explain how threads are made on a pipe.
3. Describe the different plumbing operations performed on a pipe.
4. How is pipe cutting done on site?

B. Multiple choice questions

1. Which of the following tools is used to cut the internal portion of the bolt?
   (a) Tap
   (b) Die
   (c) Cutter
   (d) Pipe threader
2. Chisel Threading machine is used to ______________.
   (a) make a hole in a pipe
   (b) make a thread in a pipe
   (c) make a die in a pipe
   (d) None of the above
3. Which of the following methods is used for pipe cutting?
   (a) Plastic tubing
   (b) Wheel cutters
   (c) Hacksaw
   (d) All of the above
4. The process of cutting thread using a tap is called________.
   (a) tapping
   (b) threading
   (c) cutting
   (d) bending
5. While conducting a pressure test, how much pressure should be retained in the pipes?
   (a) 30psi
   (b) 40psi
   (c) 55psi
   (d) 25psi

C. Fill in the blanks

1. Smoke is released from the _________ of the pipe_________.
2. _________ test is done in case of a leakage in CI pipe.
3. TPI stands for_________.
4. In manual thread cutting, normal wrench usage is to cut the threads _________ to _________ of a turn.